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ON HUMAN HAIR AS A RACE-CHARACTER, EXAMINED
BY THE AID OF THE MICROSCOPE.

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PRELIMINARY OBSERVATIONS.

FROM the highest antiquity has the human hair attracted the attention of observers; but, down to a very recent period, it was merely the contour and the external aspect which were taken into consideration. These two characters were thus at all times indicated as distinguishing nations and individuals. The terms *λειότριχες*, *συλότριχες*, *ξανθοί*, *πυρρόι*, etc., constantly occur in Greek authors and their successors.

Modern science has somewhat enlarged the field of observation as regards colour; but it was only by the use of the microscope that we are enabled to add fresh characters to those accessible to the naked eye. It is by these means that Heusinger was enabled to indicate the elliptic form of the hair of the Negro. Koelliker confirmed this observation, and added other characters. Erdl applied the microscope to the study of the colour in animals. Brown finally, according to the tendency of the American school, published in the remarkable work of Schoolcraft, his researches, in which he endeavours to establish specific characters, or nearly so, for the hair of the Aryan, the Negro, the Chinese, and the American, both in the form of the bulb and the body, and also in the structure of the latter, at least as regards the presence or the absence of the so-called medullary canal.

This question has for many years excited my warmest interest.

* Read before the Anthropological Society of Paris, March 19, 1863.

What, an anatomical system at present considered merely as a secretion of the skin, or at any rate as a simple appendage, should this represent clearly defined distinctive characters in the races of man inhabiting the globe? What, a single hair sufficient finally to distinguish one stock from another? At first, this seemed to me absolutely impossible. Nevertheless, on turning our attention to the animal kingdom as a whole, and specially to the vertebrate animals, the variety and importance of these appendages become incontestable at once. In fishes and amphibia they assume the form of scales; that of feathers in birds; and even in certain mammifers prickles are substituted for fleece. The felt of wild animals presents some distinct and constant characters in colour, texture, and distribution. In man, excepting some regions, as the face (in the male), the armpits, the pubes, etc., the surface presents generally only the rudiments of the fleece of animals; it is the hair of the head which distinguishes man in this respect.

I do not enter in this paper into the minute or elementary structure of the human hair. In this respect man differs no more from the animal than in the other organic systems, as regards their ultimate elements; hence there can obtain no difference between human races. But, as we shall presently see, there is a great difference in the conformation of the bulb or the body, as seen in transverse sections; and such there is also in the relative volume, the disposition and the contents of the medullary canal, which may even be absent. These characters can only be studied by the aid of the microscope. I have thought it proper microscopically to examine also the down on different regions of the body in individuals belonging to our race; the apes also, specially the anthropoids, seemed to me to deserve a place in this investigation.

I take this opportunity to return my sincere thanks to those honourable *savants* who have furnished me with samples of hair for microscopic examination. Without the kind aid of Messrs. Quatrefages, E. Rousseau, de Montagu, d'Abbadie, l'Abbé Domeneck, E. Duhouset, and Potteau, this unpretending treatise would probably never have seen the light.

I sincerely regret that, for certain races which inhabited or still inhabit North America and High Asia, I had no materials at hand. I would, however, fain believe that the varied forms of human hair are all represented by the samples I had at my disposal, and that, consequently, those peoples I was compelled to omit may be ranged by the side of such made known in these researches.

II. THE EXTERNAL CHARACTERS OF HUMAN HAIR AS SEEN BY
THE NAKED EYE.

The hair of the races of man presents, at first sight, very striking peculiarities in regard to its length, abundance, colour, and its smooth, curly, frizzled, crisp, or woolly condition, quite apart from the grotesque forms given to it by artificial practices which are met with both among the most civilised and the most savage peoples. This fact shows the importance which man instinctively and voluntarily has everywhere attached to that ornament which decks his head and frames his face, the noblest parts of his body.

We shall now examine the extreme variation of the characters visible to the naked eye. As regards the length of the hair, what a contrast between the stiff and sleek hair of the Blackfeet and the Sioux,* which almost reaches the heel, and the twisted tufts of the Negress and the Bosjesman, which scarcely reach the shoulder! We must take note, that the length of the hair greatly differs in the two sexes of the same stock; its length also varies so much in the same race, and even in the same families, that it is unnecessary to dwell on this character. We possess, moreover, no certain data in this respect; but, at all events, we must, to some extent, attribute the peculiarity both to the influence of climate and aliment.

The abundance of hair is subject to so many individual variations, that it cannot form a really distinctive character. As a general rule, the finer and more supple the hair, the greater the number of hairs in a given space. On this point, we need merely to compare the head of the Negro with that of an American.

The colour of the hair has at all times fixed the attention of travellers and authors. On the one hand, it harmonises to a certain degree with the colour of the skin and the iris; and, on the other, it presents more or less persistence, according to race. Black hair is met with in nearly all parts of the globe—under the equator, the pole, as well as in the temperate zone. It is the appanage of the Esquimaux, as well as that of the Negro, the Hindoo, the Malay, and of many European nations. Such is not the case in regard to the other extreme of the chromatic scale; viz. the light hair, with its nearly imperceptible shades between flaxen, straw, and gold colour, to which we must add carroty and fiery red hair. From this last there is a transition to reddish-brown; from this to light brown, dark brown,

* The hair of the mummies of the Aymarás of Peru is also distinguished by its length and stiffness.

or chestnut, etc. Among these innumerable shades, the light hair belongs to but few races, which chiefly inhabit Europe; such as the Germanic branches, Slaves and Celts of the Aryan stock, and the Finnish branch of the Turanian stock. Some light haired individuals are found among other peoples; as among the Armenians, who are partly of Aryan origin, the Semitics of Syria, among the Jews, and perhaps in Africa among the Berbers of the Atlas.* The red hair, on the contrary, seems represented, at least by some individuals, in all known races, whether equatorial or boreal. Whilst the red colour forms on the one hand, as it were, a bond of union between the most distinct races, the brown colour may be considered as establishing the transition between the light and the darkest shade. In point of fact, there are, excepting the Negroes, few black haired races among whom there are not many instances of brown hair, approaching more or less the red. This applies both to the inhabitants of the highest north, as to the Polynesian islanders, to the Americans, as well as to the Turanians, etc.

The inhabitants of Africa, exclusive of the northern coast, present few variations in the colour of the hair. This is also the case in America, where black and brown predominate. Some rare exceptions in Peru and among the Mandans deserve notice. As regards the Peruvians, we have as yet no right to discard the idea of intermixture; and as to some Mandans with light and silvery hair, living in subterraneous cabins, they always appeared to me to owe that peculiarity to a partial leucosis. Oceania resembles in this respect America, presenting the same colours, and probably less exceptions. It is different in Asia; but there also must the black and brown be considered as the most prevalent colours, excepting on some spots in the high table lands of the Himalaya, and specially in the west of that continent, where the juxtaposition or the intermixture of different races present samples of all shades of hair, as we find in Europe, here and there. It is the Aryan race in its numerous ramifications which inhabits these regions, and which presents, besides all the cranial forms, also all shades in the hair, from the jet black hair of the Hindoo to the pale yellow of the German or the Slavonian.

* Among the Berbers, I have hitherto only found that ash-grey colour, which is also met with among other allophyletic nations in Arabia, Egypt, among the Turks, etc. It must, moreover, be borne in mind, that the use of lie-wash, of powders and ointments, produces an artificial colour of the hair. I have seen all kinds of shades, from a fiery red to a silvery white, produced by these means. Just as originally dark hair may become discoloured by such means, so may it, *vice versa*, appear black, as I found in a wig from the Fiji islands. A thick black powder encrusted the circumference of each hair, and the original brown colour could only be seen after repeated washings.

From what precedes, we arrive at the conclusion that the colour of the hair alone is insufficient to characterise a race; for we have seen that the same colour—black, for instance—is the appanage of almost all the great groups of mankind, and that all shades may be met with in one and the same race. It is this last circumstance which must be taken in account in considering the question whether the colour of hair in a race may change in time and a different climate. Though numerous documents seem to refute the idea of a change, I must ask how we can explain the great variety of colour in the Aryan family, supposed to have descended from one stock; I, moreover, must appeal to daily observation. How many children with fair or reddish hair do not at puberty have it changed into nut-brown! A change in a contrary direction, that is to say from dark to light (apart from the gradual change to white by age), is rare, though not absolutely impossible. The variegated colour of the hair of an individual, and even in a single hair from the bulb to the point, must not be omitted; nor the different colour of the down covering various parts of the same body.

Characters as important as those of colour are deduced from the stiffness, flexibility, straight or frizzled condition of the hair. The hair is *smooth* when the hairs are rectilinear, *curly* when they curve at the extremity, *frizzled* when they form curves in their whole length, and *crisp* when they are disposed in small or large ringlets resembling wool.

Perfectly smooth hair is the appanage of the Americans, the peoples of High Asia, China, Japan, Malasia, etc. It is less common in Europe, and almost unknown in Africa. Curly hair is more or less found in the Aryan race, among the Semitics, in Polynesia and Australia, and individually also among the races cited above. Frizzled hair is very prevalent in Africa, arising frequently from the commixture of Nigritian blood, as in Egypt, in Abyssinia, amongst the Gallas, etc. It is also sporadically found among the Arabs and the Jews; more rarely among some European Aryans. The crisp hair predominates in Africa among the Negroes, the Hottentots, and in Melanesia.

As regards the latter region we must establish a distinction. Although there are Papuas with very fine hair, separated in tufts, crisp, and approaching that of the Negro and Hottentot, there are others who are '*mop-headed*,' wearing those enormous wigs, of which we possess descriptions and samples, and whose hair is far from presenting the characters of the first variety, as we shall show from

microscopic examination. We must here notice that Africa contains peoples possessing similar wigs as the Hadendoas, and that the Cafusos of South America offer another instance of this kind. I have, even in Europe, met with three individuals whose hair had the same aspect; but I had no opportunity of subjecting them to microscopic examination.

The general form which results from the stiffness or flexibility of the hair, appeared to me the most striking and persistent character. There is no Negro without more or less crisp hair; there is no American without hair like a horse-mane, so to say; no Aryan who possesses either of these characteristic hairs on the head. With such a result, furnished by simple inspection, we ask, what is the cause of this diversity? It is for the microscope to answer the question. It will tell us that these differences result from the thickness and the contours of the hair, apart from the various dispositions which characterise the interior of the body of the hair, which will also be revealed to us by the instrument.

One word, on the implantation of the hair on the surface of the integument, before proceeding to microscopic examination. In the great majority of the races of man, the hair issues from its cutaneous envelope in an oblique direction, and the disposition of the hairs and the down presents according to the regions of the head and the body, the aspect of vortices, eccentric and concentric curves. In the Hottentot, the Papuan with crisp hair, and in a great portion of Negro peoples, the hair is implanted perpendicularly*, and disposed in large or small round tufts. The Bosjesman presents, as far as I am aware, the smallest tufts.

III. GENERAL OBSERVATIONS ON THE HAIR EXAMINED BY THE MICROSCOPE IN A LONGITUDINAL DIRECTION.

I distinguish, like all anatomists, in each hair the root and the stem. The first consists of the bulb and the papilla. With regard to the shaft, it is not sufficient to examine it at any point in its length; it is requisite separately to examine the base, and specially the point, which presents certain peculiarities. The elements composing the hair are the epithelium, the cortical or fibrous, and the medullary substance.

1. THE ROOT. The great diversity in aspect exhibited by the hair of different races, leads to the supposition that the root should,

* Is this diversity caused by the great thickness of the scalp in the Nigritian races?

if not in structure, at least in conformation, present some notable differences. And, in fact, I have, in the hair belonging to individuals of different races, found bulbs and roots cylindrical, conical, spindle or club shaped, and others of globular form, or flattened at the base. Contractions and incisions were not wanting. The inferior extremity may be very slender or enlarged, and, in the first case, curved like a hook. I have seen such roots in desiccated hair torn from their follicles.

At the beginning of my researches, I felt inclined to consider the variations in the form of the root as race peculiarities; but, on extending my observations to a number of individuals, I changed my opinion. The reasons why I attach no importance to the form of the bulb are the following. In the first place, I found that individuals of the same race present remarkable differences in the form of the hair-bulb, and, what is more, even the hairs of the same individual show great diversities in this respect. All this may be explained by the metamorphosis of the bulb during its development, and by its gradual atrophy, which accompanies the falling off of the hair. To arrive in this respect at a fair result, we ought to examine the fresh bulbs of sound hair, which I have hitherto had no opportunity of doing.

2. *THE SHAFT.* The shaft, when subjected to microscopic examination in the direction of its length, presents differences according to the state of its development. For, before attaining its full growth, the hair passes, so to say, through an embryonic stage; and it is noteworthy that the down is abundantly intermingled with the hair in the polar races, as, for instance, in the Esquimaux and Laps.* In this stage the hair is transparent, having in the above races the appearance of a silvered empty tube; for I have never been able to detect the cellular thread which characterises the hair with a medullary substance. Whenever the point of the hair is finely drawn out, it contains a very transparent central canal. In such cases the transverse partitions gradually disappear on approaching the point; even the hair of the Bosjesman and the American possess this character.† It is rare that the portion of the stem contained in the follicle, though transparent, shows a well-defined canal.

* The same condition is observed in animals of the polar regions, in the polar dog.

† When the point of the hair, not being very fine, terminates in a pencil, the tubes composing it are equally transparent. The same thing is observed in the knots which I have seen on the hair of the inhabitants of the Deccan. These knots are bristling with small transparent and diverging tubes. I am inclined to consider these cylindrical and diaphanous cellules as the primitive element of the cortical substance, which changes its form by the juxtaposition in the mass of the stem.

Every hair completely developed, and examined longitudinally by the aid of the microscope, belongs to one of the following classes :—

(a) It presents in its whole tract a central line perfectly diaphanous, with well-defined sides, more or less wide, according to the decreasing or diminishing thickness of the hair. We are involuntarily led to consider the silvery portion a canal without medullary substance. I have employed no reagents to assure myself whether it has a cellular structure; I simply describe what I have seen, without engaging in histological researches. I also ignore whether this canal be empty or whether it contains air, a gaseous or oily fluid. I simply confine myself to describe its presence.

(b) In a second class of hair we perceive a cellular canal positively filled, and with less regular margins than in the first class. It is frequently broken off, and we find in its place a transparent gap, without any medullary substance. This is distinguished from the cortical substance by its tint, which is either darker, as a general rule, or lighter, or has a greyish, smoky aspect, specially in white hair. Thus, in black hair, the medullary substance is brownish when visible; in dark brown hair it is reddish or orange colour; it is of a golden yellow in lighter coloured hair, whether perceived in the whole tract of the hair in the form of a full canal, or whether it merely presents more or less elongated cellular clusters, which usually diminish in thickness towards their extremities.

(c) There is a third class of hair which, apart from the cutaneous extremity and the point, presents nothing in the whole tract indicative that the structure of the centre differs from the rest. There are only here and there seen fine whitish lines which might be taken as interstices situated between the elongated or fibrous cellules which constitute the cortical substance.

In reviewing the human races, and distributing them according to the three categories just established, we place in the first category the Aryan family, and specially its branches with light hair. It is only by way of exception that we find the medullary canal empty and silvery in the light hair of some Berbers, Turks, or ancient Egyptians; and in such cases the origin of the individual might be somewhat doubtful. But even in the Aryan race, the presence of a diaphanous canal is not constant. It is found in most Europeans with light hair, as in Germans, Slavonians, Celts, Frenchmen, Italians, &c. In Ireland the presence of a full canal is found in the hair of some light individuals, and the dark-haired European nations also possess, at least in the thick hairs, a distinct medullary substance, whilst the

finest hairs of the same head have an empty canal. What, therefore, constitutes the rule in the light hair of the Aryans of Europe occurs in our country as an exception in the dark hair of the same race.*

To the second category belong the greater portion of human races, such as the Esquimaux, the Laps, the Americans in general, the Turanians, the Polynesians, the Australians, &c.

The third class comprises the blackest hair. Thus, the Negro, the Papuan, the inhabitants of Southern India, the Malays, &c., possess hair which, examined in a longitudinal direction, present no difference between the cortical and the medullary substance. We should, however, deceive ourselves in deducing from this a general rule as regards these peoples. For, when the hair of a Bosjesman or a Negro is less deep in colour, when it approaches brown or red the medullary substance is seen as distinct as in other races. Besides, though in jet black hair the substance is not visible, we are not justified in concluding that it is altogether absent.

After what has been stated, we attach only a relative value to the preceding classification; for we have just seen that the Aryan race presents in its different branches all the indicated varieties as regards the relations of the central substance to the peripheral. We must, also, bear in mind that the hair of the same individual belongs, according to the degree of its development, or the variety of colour, to either of these categories. I have further observed that the three conditions indicated may be found in the same hair: thus, the point and the inferior extremity of the stem may have a diaphanous centre; the adjoining portions of these parts may have a coloured medullary thread; whilst in the intermediate portion neither of the above conditions exists.

Whilst the inspection of the hair in a longitudinal direction is indispensable for the appreciation of the value of the indicated differences, it is nevertheless insufficient to establish a convenient base of classification. There is another method to attain our object: by subjecting to the microscope the transverse section.

IV. MICROSCOPIC EXAMINATION OF THE TRANSVERSE SECTIONS OF HAIR.

The transverse sections of hair must be as fine as possible. Whenever they are coarsely made, the hair collapses in the direction of its

* The Aryans of Asia, the Persians and Hindoos, for instance, whose hair is very black, belong either to the second or third category; either their hair presents the medullary coloured thread, or nothing particular can be distinguished in the centre.

length, and we then cannot properly estimate its circumference. I used for my observations a small microscope by Oberhaeuser, Flan-din's micrometer, and microtome, very carefully manufactured by Mr. Hartnaek. Without the microtome it seems to me very difficult, if not impossible, to obtain transverse sections sufficiently fine for exact study.

The figures accompanying my description express *hundreds of millimeters*. The transverse section of the hair is sometimes quite circular, but frequently more or less elongated, when two diameters must be indicated. I always place the large diameter before the second, separating them by the mark (:) indicative of their proportion. It must also be borne in mind that the two terms of the proportion express the *absolute dimensions* in hundreds of millimeters.

The transverse sections of the hair enable us to examine the form of their contour, and to establish their different diameters and their thickness by micrometry, as well as to assure ourself of the presence or absence of a medullary substance, and its relation to the cortical substance. By these means the differential characters, if any exist in the human races, may be clearly established.

This portion of my researches being the most important, I have, for the convenience of the reader, adjoined plates. In order to exclude, on my part, any preconceived idea, I abstain from formulat-ing in this place a rigorous classification; for, before classifying, we must ascertain whether the subject admits of it. Nevertheless, in order to proceed methodically, I separate the three great races of man in well-known groups, *e.g.*, as Aryans, whatever their *habitat*; whilst at the same time I comprise such races whose hair presents analogous characters as in Negroes and certain Papuans.

Before entering into any details, I must offer some remarks, in order to avoid repetition. Hairs plucked from the same head always differ in thickness, sometimes in colour as well as in the presence or absence of the medullary substance, and its relations to the cortical substance. It is not so as regards the form of their contours; *that is nearly constant in the same individual, except in crossbreeds*. Taking these facts into consideration, I have always examined numerous sections of several hairs of the same individual, besides which I have examined the hair of several individuals belonging to the same race. As I cannot in the plates represent all the sections I made, I shall confine myself to describe their general form without neglecting such which most deviate from it. I now proceed to the microscopic examination of the transverse sections of the human hair.

The reader is requested to supply, by the study of the plates, the brevity of the descriptions. The ordinary ciphers and the French or Greek letters will easily enable the reader to find the figures corresponding to the indications of the text.

1. NEGROES (VI).* Among the six Negroes there was only one in whom the form of the contours of some of his hairs differed from the usual form.† This is elliptic in the great majority of cases. Exceptionally the ellipsis presents an inwardly curved margin, the section is then reniform, or rather the ellipsis presents a depressed spot. As a mean term, the diameters of the Negro hair are 20 : 12. The finer the hair, the greater the proportion of the small to the large diameter; thus, whilst the thickest hairs give 30 : 15,‡ the finest hair gave 18 : 10, and even 15 : 10; and if these three proportions are reduced to hundreds, it will be found that the large diameter being represented by 100, the small diameter is 50 in the thickest hair, 55 in the intermediate, and 66 in the finest hair. From these data it appears that the hair of the Negro is flattened in proportion to its thickness. In the six samples, one of which is of red colour, one-half present the medullary substance perfectly distinct at least in most of the sections. It is distinguished by a *small* central and circumscribed spot of the same form as that of the hair. In the sections as well as in the other three individuals examined, the medullary substance is absent; some marblings are, however, visible along the whole section. The hair of the Negro is thus elliptical and much flattened.§ The medullary substance does not always exist; the centre is never empty.

2. HOTTENTOT—BOSJESMAN (I). The hairs of the individual examined are some black and some white, their form being that of the Negro. The ellipsis is, however, somewhat narrower; for, as a mean term, the two diameters are 20 : 11. The sections of the white hair show the medullary substance separated, whilst the black are only marbled.

β The hair from the pubes of the Bosjesman female, known under the name of the Hottentot Venus, presented a very flattened ellipsis; the diameters, the thickest of them, are 20 : 10. Some of the sections are kidney-shaped. No trace of a medullary substance. The small circles produced by the scrolling are but 1·5 millimeters in width.

* The Roman numbers indicate the number of individuals whose hair was examined by the indicated method.

† Three sections presented in this individual a nearly circular form.

‡ The individual to whom these hairs belonged was born in Buenos-Ayres.

§ The flattening is seen in the direction of the scroll. The small circles caused in rolling present a width of 3·5 to 4 millimeters when the hairs are very fine, and in the contrary case of 5 to 8 millimeters.

3. PAPUANS OF NEW GUINEA (II). *a.* One of the heads of hair is very crisp; the form of its transverse sections, though always elliptic, is distinguished by the irregularity of one of its borders, which is either quite straight, or curved inwards in one or two spots; some sections are pointed at one of their extremities;* the proportions of the diameters denote *the greatest flattening which* I have found in human hair. The following are the dimensions—29 : 10 and 25 : 7 for the flattest; and 25 : 14 for the widest. The presence of the medullary substance is the rule in this individual, but the central spot which indicates it, is more contracted than in the Negro.

b. In the second individual, whose hairs are a little thicker, the contours of the ellipsis are more regular, though sometimes flattened on one of their borders. Diameters 32 : 14 and 28 : 13; no medullary substance in this Papuan, except in one section.

4. MELANESIANS OF OCEANIA. *a.* *From New Zealand* (IV). Three samples of these four heads of hair are of a yellow-reddish colour, the fourth is ash grey; these are likely discoloured by some hair wash. One sample presents the crisp aspect of the Negro hair, the rest present circles which succeed each other at different distances, so as to form tresses rather than tufts.

Though the general form of the sections is in these four samples still elliptic, it approaches the oval form by the enlargement of its small diameter. The crisp hair of the first sample, *a*, gives the diameters 22 : 15, whilst in the others, β , the measures give 24 : 18; 30 : 20; 33 : 22.

These hairs are generally thicker than those of the Negro, and it is a question whether the Malayo-Polynesian blood, so prevalent in Melanesia, did not run in the veins of the individuals whose hair is under examination. As regards the medullary substance, it is present in two samples and absent in the rest.

b. *Néo-Caledonians* (I). The same doubts as regards origin arise in the only specimen of hair I possess from New Caledonia. By its long exposure to the air the colour is ash-grey; it is much curled in all its length; the form of the section approaches the oval, but the margins are somewhat curved; the diameters vary between 30 : 20 and 27 : 25; the medullary substance is well defined.

c. *Tasmanians* (II). Two specimens from Van Diemen's Land, one black, the other yellowish-white, approach the hair of the New-Irelanders by their tresses, their diameters, and internal dispositions. Diameters of the black hairs = 25 : 15; of the light hairs = 25 : 15

* Compare with the Negro of Buenos-Ayres.

to 27 : 20. The first has no medullary substance; the second has it much enlarged.

5. ARCHIPELAGO FIJI (IV). Two of the four specimens are of a reddish flaxen colour, the two others blackish-brown. One of the last heads of hair has the appearance of a large mop-shaped, very crisp wig. This and the two first are characterised by the great thickness of each individual hair, the yellow or orange colour in the interior of the sections, the large black central spot, and by the elliptical form of the contours, which predominates in spite of the irregularities presented in this respect by the hairs of the wig; where we observe reniform and triangular sections with depressed points and irregular margins, forms which are seen in the hairs of the beard in the Aryan race. Diameters = 35 : 20 and 33 : 20 in two individuals; but in the wig we find 40 : 22; 37 : 22 and even 37 : 20 for the elliptical sections with regular form.

One of the specimens, which is of a blackish-brown, is distinguished from the rest by its relative fineness, and by the tendency of its sections to the oval form. Diameters = 28 : 20 and 22 : 16.

6. POLYNESIA. *a. Nukahiva* (I). Hair slightly frizzled and dark brown. The sections of the thick hairs have an elliptic form, whilst the fine hairs tend to the circular form.* Diameters = 30 : 15; 30 : 20; 25 : 20 and 22 : 10. The interior of these sections is reddish and marbled, scarcely any trace of a central spot.

b. Tikopia (II). One specimen of hair smooth, amber colour; the second specimen, of the same colour, but intermixed with reddish-brown hairs. Besides the ellipsis ordinarily with one straight border, there are observed sections enlarged in their small diameter and approaching the oval form. The diameters vary between 30 : 20; 27 : 12 and 27 or 23 : 20. The interior of the section presents the central spot or marblings.

c. New Zealand (III). These three scalps, black and dark-brown in colour, show in their sections a greater tendency to the circular form than the preceding. Diameters = 30 : 20; 30 : 25; 25 : 17 and 20 : 15. The central spot is very distinct.

7. MALASIA (I). Hair of a Malay girl, jet black, and slightly curled at the point; it presents, in its sections, forms intermediate between the circle and the perfect oval. Diameters = 35 : 27; 26 : 18; 25 : 17; 28 : 20 and 23 : 20. Some sections are irregular; the greater portions are only marbled; others have a central spot.

* Should this be a cross-bred?

8. AUSTRALIA (II). Hair from Port St. George; black, much scrolled, and consequently of doubtful origin, presents in its sections an enlarged and irregular ellipsis. Diameters = 30 : 20 : 25 : 20. Central spot very large.

Another specimen from the same country; colour red and very curly, consisting of finer hair, the sections of which are much flattened; their predominant form is the irregular ellipsis; there are also reniform sections. Diameters 25 : 15 to 25 : 30. Marblings without central spot.

9. JAPANESE (II). Man, and a girl seventeen years old. Hair of the male very black, stiff, and glossy; sections *perfectly round*. Their diameter is comprised between 25 and 22. The interior is marbled, rarely containing a small central spot. The sections of the hair of the girl present the same regular forms; most are round, some elongated; all have a large central spot. Diameters = 25 for the round, and 27 : 23 for the elongated.

10. SIAMESE (IV). Hair black and smooth. Besides perfectly circular sections, there are, in all individuals, some a little elongated. These latter present the following diameters: 28 : 20; 27 : 24; 26 : 24; and the largest are 30 : 23; 30 : 25. The greater part of the sections have a small central spot.

11. CHINESE (I). The hairs of the Chinese present sections of various forms, from the circular to the elliptic; the ellipsis is, however, never narrow. The following are the diameters for the elongated sections = 33 : 24; 30 : 21; 31 : 19; 30 : 25. The central spot is met with in one-half of the sections.

A cross-bred, whose father is a Chinese, and the mother a Siamese, presented in the sections of the hair a more or less circular form without any central spot.

12. AMERICANS FROM THE NORTH (I). I had only a few hairs from the cranium of a Choctaw at my disposal. The form of the sections of the fine hairs is nearly circular, whilst that of the thick hairs is somewhat elongated. The diameters of the latter are = 25 : 20. In the interior are seen marblings rather than central spots.

13. AMERICANS OF THE SOUTH. *a. Mummies of Aymards of Peru* (II). Hair very smooth, of considerable length, and of red colour, approaching brown. The form of the sections is nearly circular; but the margins are nearly always irregular and angular. The most elongated rings have diameters from 25 and 26 : 23. The central spot which exists in most of the sections is very large.

b. Americans of the South (1).^{*} Hair black and coarse. The principal form of sections is a circle of 25 in diameter, with a small central spot. The diameters of the elongated sections are = 20 : 19, and present in their interior marblings rather than a separate medullary substance.

c. Tribe of the Jambas (1)†. This glossy, dark, and very coarse hair, presents all forms from oval to the circle; hence a great variation as regards the diameter = 33 : 15; 33 : 22; 25 : 20; 25 : 23. Small central spot in all the sections.

It appears to me of interest to add to the preceding observations relating to deceased persons of probably pure origin, the following three made on living subjects of the same continent.

a. M. M—, a native of the Peruvian Andes, aged sixty-three, according to his own account a pure Indian. He is of lank stature; cranium brachycephalous and square, as usual in the Aymara race; cheekbones slightly prominent. The colour of the skin, and the *ensemble* of his physiognomy and stature, do not show his origin; the form of the cerebral cranium is, however, decidedly Indian. Let us now see what says the hair, which *M. M*— assures us was formerly light, but is now whitened, inclining to a greenish-yellow; it is also stiff.

What strikes us in the sections of this hair, is the complete irregularity in its contours,‡ and the tendency of the small diameter to enlarge; a single section, which is the smallest of the five I have examined, presents the circular form without central spot. In all the others the medullary canal is very large. Diameters = 30 : 18; 30 : 22; 25 : 20; 18 : 15, and 12 : 12.

β The son of the preceding, a boy twelve years old, whose mother is also an Indian woman, has a head of hair very abundant, thick, slightly wavy, dark brown.§ The sections of his hair are distinguished by their irregular contours; the smallest are rounded or square, whilst the larger are rather elongated. The form of the latter varies between a widened oval and pointed on one side (27 : 25), and an ellipsis with more or less interrupted borders (30 : 17; 30 : 20; 25 : 20). No traces of a medullary substance; the centre is transparent. Will this be the case at a more advanced age? We doubt it, as the father possesses the usual pigment, and we shall see in the

* Without any indication as regards origin.

+ Province of Macas.

‡ This peculiarity appears to me to depend somewhat on age; for I have observed it, though less marked, in the hair of aged Aryans.

§ Excepting in the colour of the skin, the boy presents the Indian type.

sequel, in the children of the Basques, that they are in the same condition compared with the adults.

γ. M. M—z of Lima, aged twenty-three. His father is a Spaniard, his mother an Indian. His hair is black, fine, very curly. The form of the sections presents, only exceptionally, that of an ellipsis (25 : 13), of a widened oval (26 : 21), and of triangles blunted at the points. The centre is perfectly transparent. Mr. M—z has the features of the Spanish stock, and slightly Semitic.

14. ESQUIMAUX (II). One of the specimens, black in colour, presents a round, or but little elongated form. Diameter of the first = 30, of the second = 20 : 17. Another specimen, altered in colour and in structure by its position in the earth, presents, besides round, also elliptical sections, with irregular, straight, or curved borders. The diameters vary from 36 : 20 to 25 : 22. Whilst the first specimen of hair is marbled in its sections, the second shows, in the middle of these sections, large holes with regular contours. Thus the medullary substance resisted decomposition less than the cortical.

15. MONGOL (I). Hair reddish brown, intermixed with red hair. The form of the sections approaches the circular. Diameters 33 : 30; 25 : 23; 27 : 22. The central spot is large, and nowhere absent.

16. TURKS (II). One of the specimens, yellowish-grey, belongs to a Turk of Smyrna.* Though there are some rounded sections without central spot, the greater portion are very elongated, and present a small spot in the centre. The diameter of the latter varies between 30 : 15 and 23 : 17. The second of these sections belonged to a Kouroglou of Algeria. It is greyish-red, and is distinguished by the predominance of the round form in its sections, some of which are of a wide oval form = 17 : 15. It is noteworthy that the centre of all the sections is perfectly diaphanous.

17. EGYPTIANS. a. *Modern* (II). Though one specimen of these hairs be slightly frizzled and the second smooth, they present a great analogy in the form of their sections. The colour is intensely black. The predominant form is the ellipsis, with very irregular borders; most of the sections are reniform. By the side of these curved ellipses there are some very abnormal in form, more or less triangular.† In the ellipsis the diameters are 40 : 17; 30 : 18 and 17; 30 : 15; in the finest hairs, 25 : 15; 28 : 15. Central spot very large in all the sections.

b. *Mummies* (VI); a. *with thick black hair* (III). Of these antique

* The origin of this individual is doubtful.

† Compare the wig of the Fiji with the hair of the beard.

specimens of hair one only exactly corresponds with the preceding by the generally elliptical form of its sections and by the thickness of the hair (33 : 17; 33 : 20), as well as by the well marked central spots. The two other specimens show, in the form of their sections, a tendency towards the oval form (30 : 20; 22 : 15; 20 : 15). These are somewhat finer, with more regular contours; the medulla is not always separate from the cortical substance.

β . Two specimens are brown inclining to red, and one is of reddish-yellow colour (iii). The hair in these specimens is finer than in the black. The darkest incline towards the enlarged oval form, of which the following are the proportions, 25 and 26 : 20; 23 : 17 and 18. Most of the sections have a transparent centre, a few only show a small spot. The two lightest specimens furnished elliptical, mixed with oval sections, of the following dimensions: a , 25 : 15 and 20; 11 and 12; * b , 25 : 20; 25 : 15 and 15 : 10. We must also notice that a presents the central spots, whilst that of b is perfectly diaphanous.

18. BERBER KABYLE (i). The form of the sections varies between the ellipsis and the oval. Diameters = 28 : 17; 26 : 15; 25 and 23 : 18; no central spot.

19. ARAB (i). This specimen of black hair presents in the sections chiefly the elongated irregular ellipsis (34 : 18; 32 : 16), with small central spots, also some triangular sections† by the side of a secondary form, which is oval (23 : 17; 20 : 16), and without any central spot.

20. EAST INDIANS. By the kindness of Mr. de Montagu and his friends in India, Colonel Pope, Colonel Speak, and Dr. Leith, I am in possession of sixteen specimens of hair from natives of the Presidency of Bombay and the central Deccan. In order not to encumber this short sketch with too many details, I shall confine myself to state the result of my researches on the hair of such native Indians considered as belonging to the primitive stock, to which I shall add the Hindoo Brahman as a member of the Aryan family. These specimens of hair are all, without exception, of a jet black, metallic or silky gloss, and the hairs more or less fine and curly; all this is probably the effect of climate. By the aid of the microscope we may ascertain what belongs to the race.

a . *Gond* (i). The predominant form of the sections is elliptical (25 : 13 and 15); others present the pointed oval form (25 : 20), and

* a reminds us of the Bosjesman and the Negro, and b of the Aryan; but the presence of the two forms upon the same head modifies the first impression.

† Compare with the modern Egyptian, in whom there is sometimes a mixture of Arab blood.

there are some few perfectly round. Marblings in the interior; no central spot.

b. Kole (I). Scarcely any section of elliptical form; the greater number incline towards the wide oval; generally great tendency towards circular contours. Diameters 33:22; 23:17; 25:20; 23:20. Marblings, or very small central spots.

c. Bhil (I). Form of sections, either an irregular ellipsis or an enlarged oval. In the first variety there is usually a small central spot; in the second only marblings. Diameters 30:17 and 20; 26:18; 20:17.

† As regards the form of the sections all the other specimens belonging to the natives of India may be divided into two classes. Either it is the reniform ellipsis with a central spot which predominates, as for instance in a man of Ahmedabad, in a Varouli, and a Kathkouri; or the form is circular mixed with irregular sections, which predominate, as in an individual of Mhar. In this specimen the central spot is seen also in the nearly circular sections. These specimens present on the whole in their sections the two extreme forms. Ordinarily one of these forms predominates in the same head, intermixed with intermediate oval forms. My researches are, however, not sufficiently advanced to shew in such cases the primitive forms and the stock from which they are derived. I can only state the facts.

d. Brahman (I). Very regular form of sections presenting a striking resemblance to each other; sometimes an ellipsis, the long borders of which very straight, the small curved, sometimes an oval. Diameters, 22:14; 28:16. A small central spot well defined, presents the same contours as the section in general.

21. PERSIANS (II). The hair of these two specimens is somewhat thicker, as in the preceding. The forms of the sections are the same; namely, oviform ellipses, but with more equally curved border. Diameters, 30:17; 29:18; 29:20; 26:17. In one specimen the centre is diaphanous, in the second there is a well defined small spot.

22. ARYANS OF EUROPE. *a. Italian* (I). Hair chestnut colour. Sections oval, 23:17; 20:15; centre transparent.

b. Germans (IV). Hair sombre flaxen, or light chestnut colour; two specimens of males and two of females. The general form of the sections is oval and regular. Exceptionally the borders are somewhat straight, angular or curved. Among a considerable number of sections the flattest is 30:16, and the most circular 25:30. The great majority presents the following dimensions: 22:15; 21:15; 25:15. In one specimen of the two males, and one of the two females, the

centre of all the sections is transparent; in the other of the male it is only transparent in some, and in the second female specimen it is scarcely transparent in any.

c. Lithuanians (II). The colour of these two specimens is of straw-yellow.* The sections are oval, with a tendency to the circular form, specially so in one specimen. Diameters, *a*, 24 : 19 ; 27 : 20 ; —*b*, 28 : 17 ; 28 : 20 ; 23 : 20. The centre is, without exception, transparent.

d. Irish (XLVIII). Excepting a single specimen obtained from a turf-pit, this collection has been formed from living persons by Abbé Domenech. I have subjected all these samples of hair to a double examination; first, to ascertain the variations of the hair in a nation comparatively little mixed, and composed, as history teaches, to a great extent of Aryan elements; and, secondly, to assure myself whether there be an allophyletic stock intermixed with the Aryans. Moreover, accident having placed at my disposal a specimen of hair of great antiquity, its comparison with that of the living might furnish a base for the establishment of what is constant in human races, even in a system of the organism which presents such small proportions.

A. The hair obtained from the turf-pit is smooth and reddish-brown. Sections oviform and elliptical = 22 : 16 ; 22 : 15 ; 20 : 15. The centre presents in most cases a small central spot; it is diaphanous in others.

B. The other forty-seven specimens may, according to their colour, be divided into three series, of which the first (16) comprises light hair, mostly golden light; the second (16) comprises dark hair, and the third (15) black hair. To spare the reader the trouble of tiresome details, I present a summary of the results obtained by the examination of the sections. And first, with regard to the volume of the hairs, the lighter the colour the finer the hairs, and *vice versa*. This rule is, however, subject to exceptions; there are three specimens of golden light, the hair of which attains the thickness of the black hairs. As regards the form of the contours of the sections, there is not a single specimen which does not present elliptical or oval sections; but whilst this is the predominant and almost exclusive form in the light hair, there are, on the contrary, in the dark specimens, besides elongated sections, others more or less circular. The irregular contours are rare in the first variety, and very frequent in the second. The light and fine hairs have generally a transparent centre,

* The cranial type of these two young savants is that of the Slavonian race, both in the cerebral as well as the facial cranium.

whilst the black as well as coarse light hair present central spots, at times very large. When now we consider the sufficiently constant form and volume of the hair belonging to the branches of the Aryan family, characters which are to a considerable extent found among the Irish, we can only, as regards the variations, attribute them to the commixture of a foreign element.* The examination of the hair of Basques will confirm this view. It results farther, from this examination, that in the intermixture of races there may be not merely fusion, but a change of characters; at least as regards the hair.

The following table, containing the measures of the extreme forms, will support the preceding remarks:—

B. LIGHT HAIR. <i>Ordinary Proportions with Trans- parent Centre.</i>	C. BLACK HAIR.
a. 20 : 15; 21 : 15; 20 : 13.	22 : 13; 15 : 12; 12 : 11.
β. 27 : 12; 25 : 12; 25 : 15; 20 : 12; 20 : 15.	31 : 20; 35 : 15; 24 : 20; 25 : 20.
<i>Exceptional Proportions and Central Spots.</i>	
γ. 30 : 16; 26 : 16.	34 : 15; 30 : 16; 27 : 15.
δ. 32 : 20; 30 : 21; 25 : 15.	30 : 18; 30 : 25.
ε. 34 : 19; 33 : 21; 27 : 15.	32 : 20; 23 : 21.

23. BASQUES. All shades, from flaxen to deep black, are represented in the Basques of the present day. The light colour is preferentially found among those inhabiting the coast and the highest mountains. The average colour of the hair of the Basques is chestnut.† The light hair curls very easily, which is generally not the case with the black.

a. Specimen of black hair from a child aged 11; some light coloured hair in the occipital region. All the sections approach the circular form; the most elongated are 25 : 20. No central spot.

b. Adult male with stiff black hair. All the sections are oval or enlarged ellipses; some are triangular. Central spot well marked. Diameters, 29 : 20; 23 : 18; 24 : 22; 27 : 23.

It is evident that these specimens approach both the American and the Turanian, just as the language of the Basques recalls the Iberian origin.

We now examine the light hair.

* The craniological researches of Mr. Wilde evidently prove that, before the historical epoch, there existed in Ireland, as well as in England, Scotland, France, etc., two different races, the one brachycephalous, and the other dolichocephalous.

+ The Basques are, in my opinion, far from constituting a homogeneous race. I believe them, on the contrary, to be much mixed. The marriages of the ancient Iberians with the Celts have been already noticed by the classical authors. The study of the physical type, specially of the cranium (see M. Broca's collection in the Museum of the Society), confirms these historical data.

a. Specimen of light colour inclining to chestnut, wavy, much curled. Sections elongated and oviform, most of them without central spot. Diameters= $30:15$; $30:20$; $25:15$.

In order to show the effect of the commixture of heterogeneous races, as for instance the Aryan and Iberian, I have examined the hair of two brothers, whose father is a Basque and the mother an Irishwoman. The following are the results of the examination:—

A. Chestnut coloured hair, intermixed with white hairs, slightly curled. Most of the sections are elliptical, narrow, with a diaphanous centre. Diameters = $25:15$; $22:17$; $22:15$. But besides this predominant form, there are circular and triangular sections, &c. These latter sections have sometimes a small central spot.

B. Hair darker and stiffer. The elongated form of the sections is not absent ($30:15$; $25:17$; $20:15$; $20:17$); but more than one half of the sections approach the circular form and have a central spot, though it is smaller than in the Basque with black hair.*

24. *French.* The hair of the French, of which I have examined a considerable number of specimens, presents all the shades and forms found in the series 22 and 23, which is explained by the multiplicity of ethnic elements which compose that great nation.

SUPPLEMENT.

I.—*Examination of the hair in some other parts of the body.*

1. *Italians.*—*a.* Moustaches. Hair, white and yellowish. Most of the sections are very irregular in form, resembling, for example, a triangle, or the form of the sole of a shoe, etc.† These thick hairs attain considerable dimensions; the following are the measurements: $55:30$; $48:30$; $45:30$; $27:25$. The central spot is of relative size. In no section is it entirely absent.

b. The hairs on the genitals are also very thick; their contours are more regular, though some have very singular forms. In the sections with regular forms, the central spots are relatively small. Diameters = $38:15$; $38:18$; $38:23$.

c. The hairs on the coccygian region are fine, and approach, much more than the preceding, the hair on the head, by their dimensions and forms. Diameters = $23:14$; $28:13$. Scarcely any traces of a central spot.

d. The hairs on the chest present, generally, the form of a shoe-

* Of these two brothers, A represents the elongated cranium of the Celts, despite the Iberian origin of his father; whilst the cranium of B is rounder.

† That which is the exception in the hairs of some individuals, is the rule as regards the beard.

sole; some of the sections are more regularly elliptical. Diameters = 38 : 37 and 36 : 20. Large central spot.

e. The hairs of the armpit, all with very diaphanous centres, present in their sections more or less regular ellipses. Diameters = 30 : 16 ; 32 : 18 ; 30 : 13 ; 23 : 15.

2. *German*. The same characters as in the Italian are observed in the hair of the beard and the armpit. The hairs on the genitals present no abnormal form.

f. The down on the back of the hand presents in the section the oval form with transparent centre. Diameter = 13 : 9.

II.—*Hairs on the heads of Anthropomorphous Apes.*

a. *Male Chimpanzee*. The sections are large : between 30 and 23. Their form is generally circular or nearly so : for example, 25 : 24.

Female Chimpanzee. Hairs somewhat finer. The complete circular form more rare, approaching rather the oval. Diameters = 24 : 20 ; 18 : 14, and exceptionally 25 : 16.

In both sexes no trace of a medullary canal.

β. *Male Adult Gorilla*. Hairs very thick. The form of the sections rather irregular; partakes of the ellipsis and the oval. Diameters = 37 : 25 ; 35 : 25 ; 40 : 31 ; in the finest = 27 : 23. The medullary canal is enormously large.

† *Young Female Gorilla*. Hairs finer. Their sections are either very regular, or with borders, if not angular, at least deviating from the regular curve. Diameters = 20 : 15 ;* 22 : 16 ; 17 : 10. The medullary canal is small and *rarely placed in the centre*.

γ. *Orang-Outang*. Sections large and elongated in ellipses, without central spots. Diameters = 35 : 20 ; 31 : 18.

b. *Gibbon (Rafflesii)*. Hairs extremely fine. Sections oval and very regular, without central spots. Diameters = 15 : 12 ; 13 : 10.

c. *Cynocephalous Baboon*. Besides circular sections there are some elongated, with irregular contours. Diameters of the first = 25 ; of the second 25 : 20. Central spots *very large and elongated*.

Résumé.

1. Microscopic examination accounts for the different aspects which the hair of the human races presents to the naked eye. The flatter the hair the more it curls, and the rounder the hair, the more stiff and smooth it becomes.

2. One extreme end of the scale is represented by the Papuas, the

* A striking analogy, in early age, with the Aryan race, at least in regard to the diameters of the first two sections.

Bosjesmans, and the Negroes; the other by the Polynesians, the Malays, the Siamese, the Japanese, the Turanians, and Americans, not excepting the Esquimaux. The Aryans occupy the intermediate space.

3. The Basques differ from the Aryan stock as much by their hair as by their language.

4. Cross-breds are recognisable by the fusion and juxtaposition of the characters inherent in the hair of their parents.

5. It is much less the anatomical disposition of the constituent elements, than the *form* of the hair, which produces the characteristic differences. Anatomically there would only be the transparent centre deprived of medullary substance in some branches of the Aryan race which would deserve to be considered. But the fine points of the hair belonging to allophyletic races, as well as their down, present the same peculiarity.

6. A single hair, presenting the average form characteristic of the race, might serve to define it. But without pretending to this degree of certainty, it is indubitable that the hair of the individual bears the stamp of his origin.

7. Though there are appreciable differences in the form of hairs in the same individual, the extreme forms are only met upon the same head where there is commixture of blood.

8. The small scale assigned to the diameters of the hair explains the relative resemblances between single hairs belonging to individuals of different stocks; but in spite of this apparent inconvenience, the general or predominant form of the sections does not in the same race transgress certain limits, and it is upon this that we must base our diagnosis.

9. The hair examined by our method appears to us to possess an incontestable value for the study of characters inherent in the races of man.

10. Some will find in it forms of transition, for instance, from the Polynesian to the Melanesian, from the Malay and Lithuanian to the Turanian, etc.; from this and the Basque to the American, etc.; whilst others may energetically point out the different and constant forms even in this apparently insignificant appendage of the skin.

11. It is with the form of the hair as with the form of the cranium, however unequal may be the importance of these two characters.

12. I have confined myself to the study of facts. But whilst admiring the incomparable wisdom of the Creator, who has so marvelously diversified what is apparently so minute, I declare my inability to trace it back to the origin of the creature.